MALVERN U3A GEOLOGY GROUP

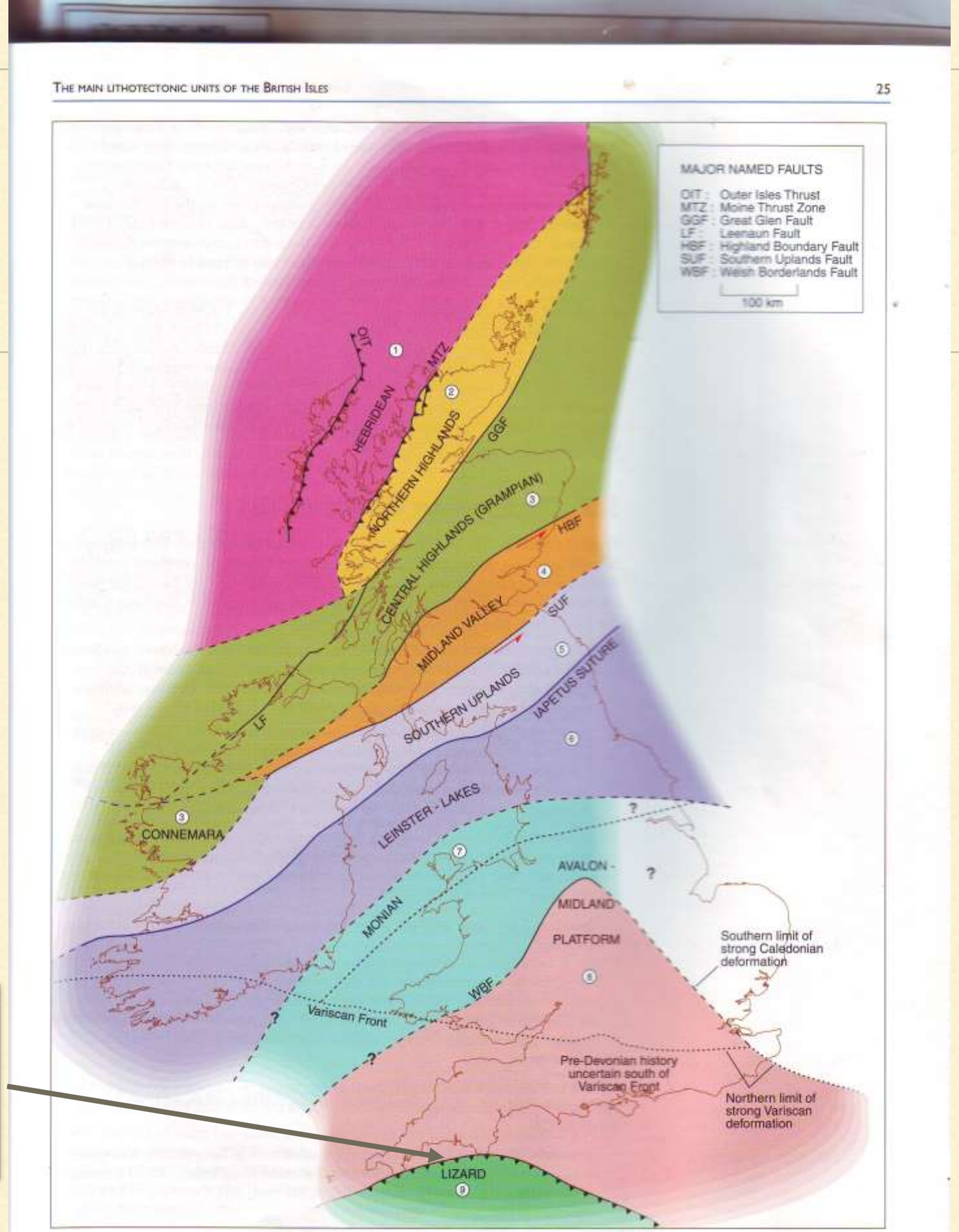
South Devon Field trip October 2014
leader Nick Chidlaw Maps

Ma

Mary, intrepid as ever.


CAERAU
CARDIFF
BARRY
WESTON-SUPER-MARE
BERROW
ILFRACOMBE
LYNTON
PORLOCK
MINEHEAD
LUNDY
WOOLACOMBE
M5
SIMONSBATH
WILLITON
BRAUNTON
BARNSTAPLE
BRIDGWATER
APPLEDORE
WIVELISCOMBE
SOUTH MOLTON
ATHERINGTON
TAUNTON
GREAT TORRINGTON
BAMPTON
CHULMLEIGH
WITHERIDGE
KILKHAMPTON
TIVERTON
CULLOMPTON
BUDE
HATHERLEIGH
HOLSWORTHY
CREDITON
HALWILL
A30
HALLWORTHY
A386
EXETER
A38
LYME REGIS
BRANSCOMBE
PADSTOW
BOLVENTOR
EXMOUTH
DAWLISH
WADEBRIDGE
PRINCETOWN
ASHBURTON
SAINT COLUMB MAJOR
CALLINGTON
YELVERTON
TORQUAY
TAMERTON FOLIOT
PAIGNTON
SAINT AUSTELL
PLYMOUTH
DARTMOUTH
EAST LOOE
NEWTON FERRERS
TREGONY
SALCOMBE
SAINT MAWES

The 9 terranes of the British Isles



Terrane bounday which runs across the south tip of Devon,
East -West through Hope Bay

(a) LATE PROTEROZOIC ~550 Ma

(b) EARLY ORDOVICIAN ~490 Ma

(a) The northern British Isles is located at the passive margin of Laurentia, while the southern British Isles is situated behind the subducting margin of Avalonia, a micro-continent on the edge of Gondwana. Both Laurentia and Avalonia are south of ~40° S and are separated from each other by a spreading ocean (which becomes the Iapetus).
(b) The southern British Isles is still located at the margin of Avalonia, which has drifted southwards to ~60° S. In contrast, Laurentia, carrying the northern British Isles, has started to drift northwards, residing at ~20° S, separated from Gondwana by the Iapetus Ocean (which is now beginning to close).

(c) LATE ORDOVICIAN–EARLY SILURIAN ~450–440 Ma

(d) MID–DEVONIAN ~375 Ma

(c) The Iapetus Ocean has been progressively closing, bringing the micro-continent of Avalonia (including the southern British Isles, ~30° S), closer to Laurentia (including the northern British Isles, ~20° S). At the northern margin of the ocean, subduction is occurring below Laurentia, whereas the southern margin with Avalonia is passive. To the south of Avalonia, the Rheic Ocean is actively spreading.
(d) 'Zipper-like' continental collision has been occurring between Laurentia and Avalonia, uniting the British Isles along the Iapetus suture zone (purple line). This collision is known as the Caledonian Orogeny. At this time, the British Isles are at ~20°–25° S, located within the southern desert latitudes.

(e) CARBONIFEROUS ~302 Ma

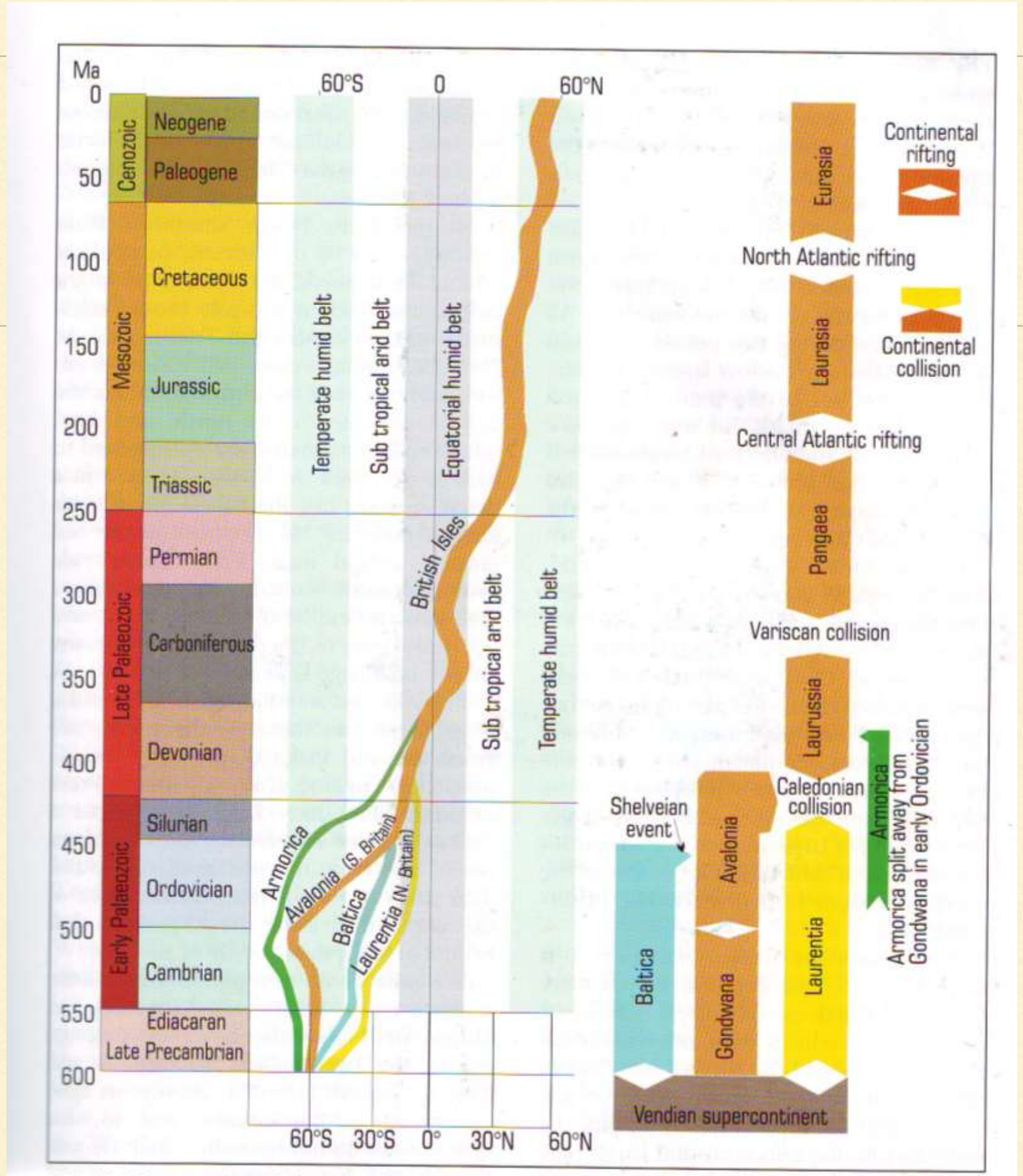
(f) TRIASSIC ~237 Ma

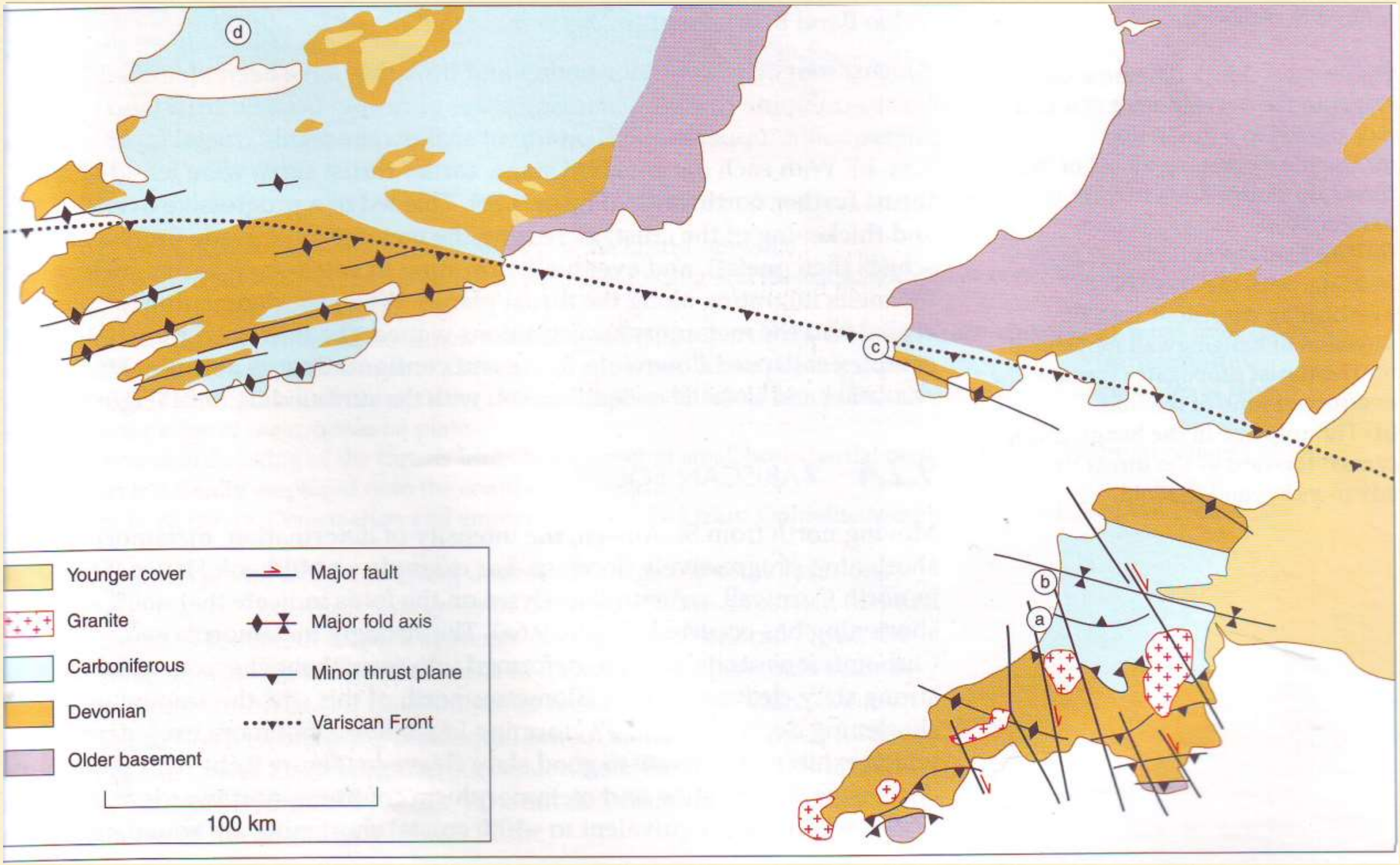
(e) As the Rheic Ocean closes between Laurentia, Eurasia and Gondwana, the Variscan Orogeny starts to affect the southern British Isles. During the Carboniferous, continental drift has carried the British Isles northwards across the equator, into subtropical latitudes.
(f) All of the landmasses have united to form the supercontinent Pangea. To the east, Tethys is actively spreading, while the British Isles continues to drift northwards to 20°–30° N, equivalent to the modern day Sahara latitudes.

(g) JURASSIC ~195 Ma

(h) LATE CRETACEOUS–EARLY TERTIARY ~65 Ma

(g) Break-up of Pangea results in Gondwana and Laurasia separating, as the southern Atlantic Ocean starts to rift open. The British Isles continues to drift northwards to ~35°–40° N into more temperate conditions, with lithospheric extension and passive rifting occurring to the east (forming the North Sea) and west (where later the North Atlantic will open).
(h) Passive rifting has given way to active rifting to the west of the British Isles, allowing the northern Atlantic Ocean to continue opening in a zipper-like fashion northwards. Active sea-floor spreading is occurring throughout the Atlantic, Indian and Pacific Oceans, whilst Tethys closes, resulting in the eventual collision of Africa, India and Eurasia.


Ma
0
50
100
150
200
250
300
350
400
450
500
550
600
Cenozoic
Mesozoic
Late Palaeozoic
Early Palaeozoic
Neogene
Paleogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Late Precambrian
60°S
0
60°N
Temperate humid belt
Sub tropical arid belt
Equatorial humid belt
British Isles
Sub tropical arid belt
Temperate humid belt
Armorica
Avalonia (S. Britain)
Baltica
Laurentia (N. Britain)
60°S
30°S
0°
30°N
60°N
Eurasia
Continental rifting
North Atlantic rifting
Laurasia
Continental collision
Central Atlantic rifting
Pangaea
Variscan collision
Laurussia
Caledonian collision
Shelveian event
Avalonia
Armorica
Armorica split away from Gondwana in early Ordovician
Baltica
Gondwana
Laurentia
Vendian supercontinent



Variscan folding, faulting and thrusting

Variscon folding showing increasing folding and shortening from NW to SE

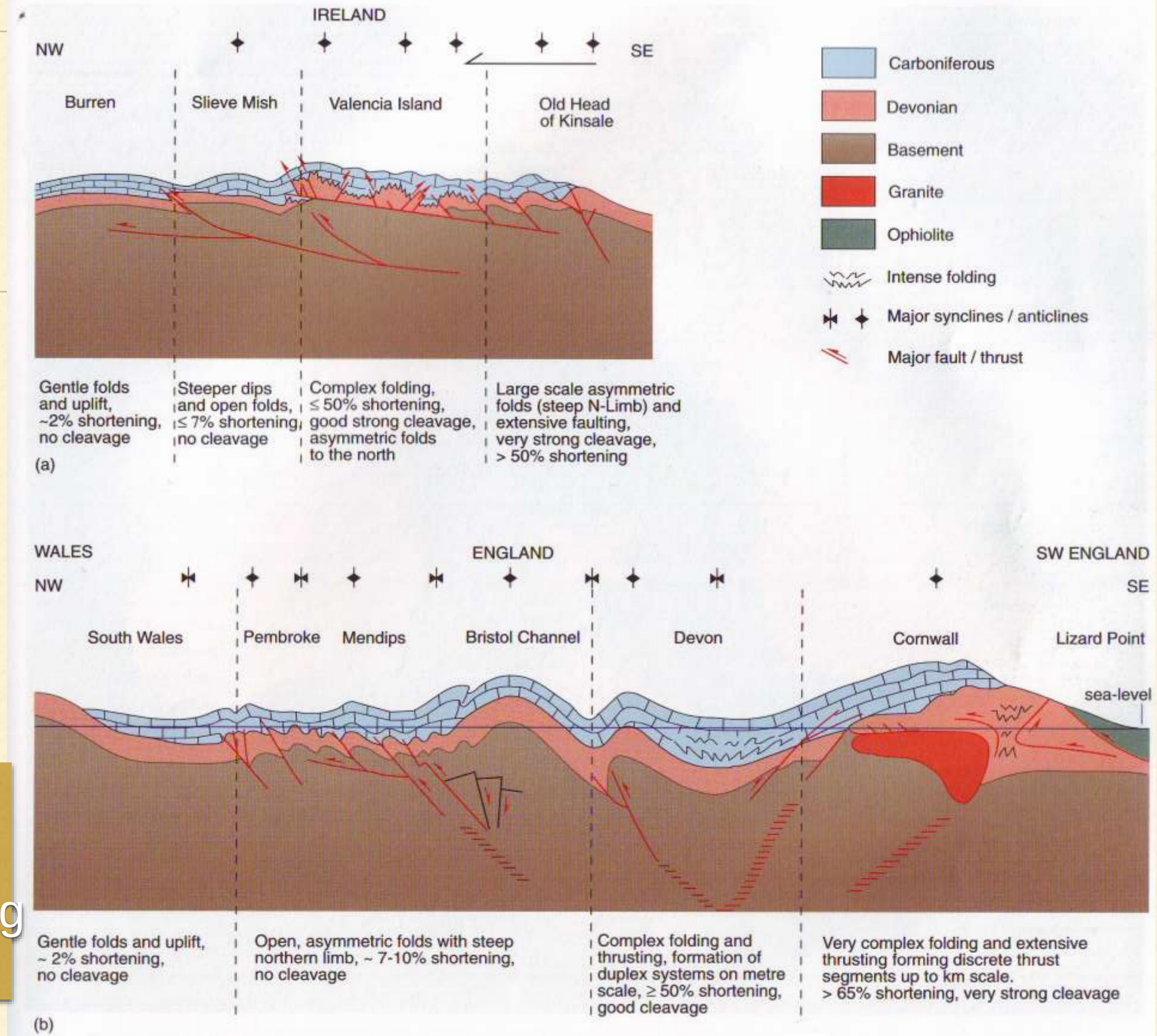
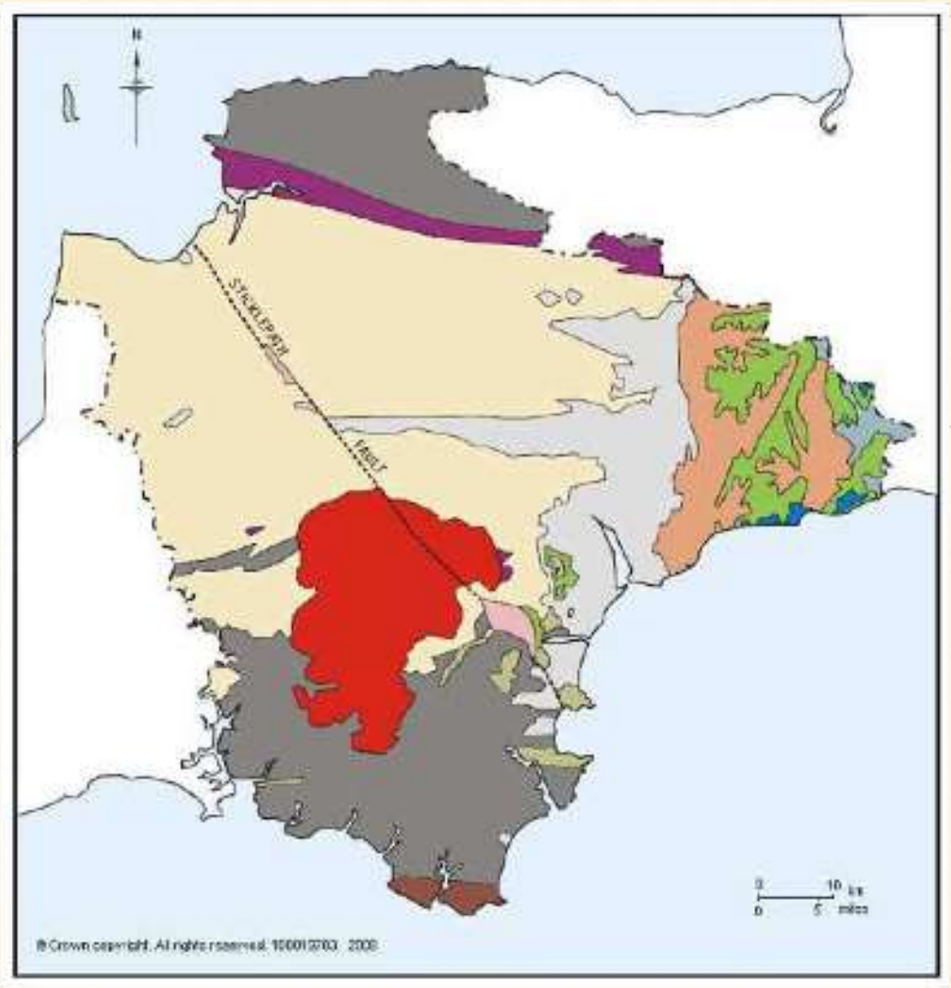


Figure 9.7 Schematic cross-sections illustrating the progressive increase southwards in folding, deformation and metamorphism associated with the Variscan Orogeny for (a) the south of Ireland from the Burren (County Clare) to Kinsale (County Cork) and (b) south Wales north of the Variscan Front to Lizard Point, south Cornwall.

Summary Map of the Geology of Devon



KEY

Quaternary Deposits and Landforms	**These recent deposits are not on the map**	Permian Breccias, Sandstones and Volcanics	
Tertiary Deposits		Dartmoor Granite	
Lundy Granite		Carboniferous Sandstones and Shales	
Chalk		Transition Group (Devonian to Carboniferous boundary)	
Upper Greensand and Gault		Devonian Slates, Sandstones and Volcanics	
Lower Jurassic Mudstones and Limestones		Devonian Limestones	
Triassic Pebble Beds, Sandstones and Mudstones		Lower Devonian Schists	

millstone grit

granite pluton

Tavy form.

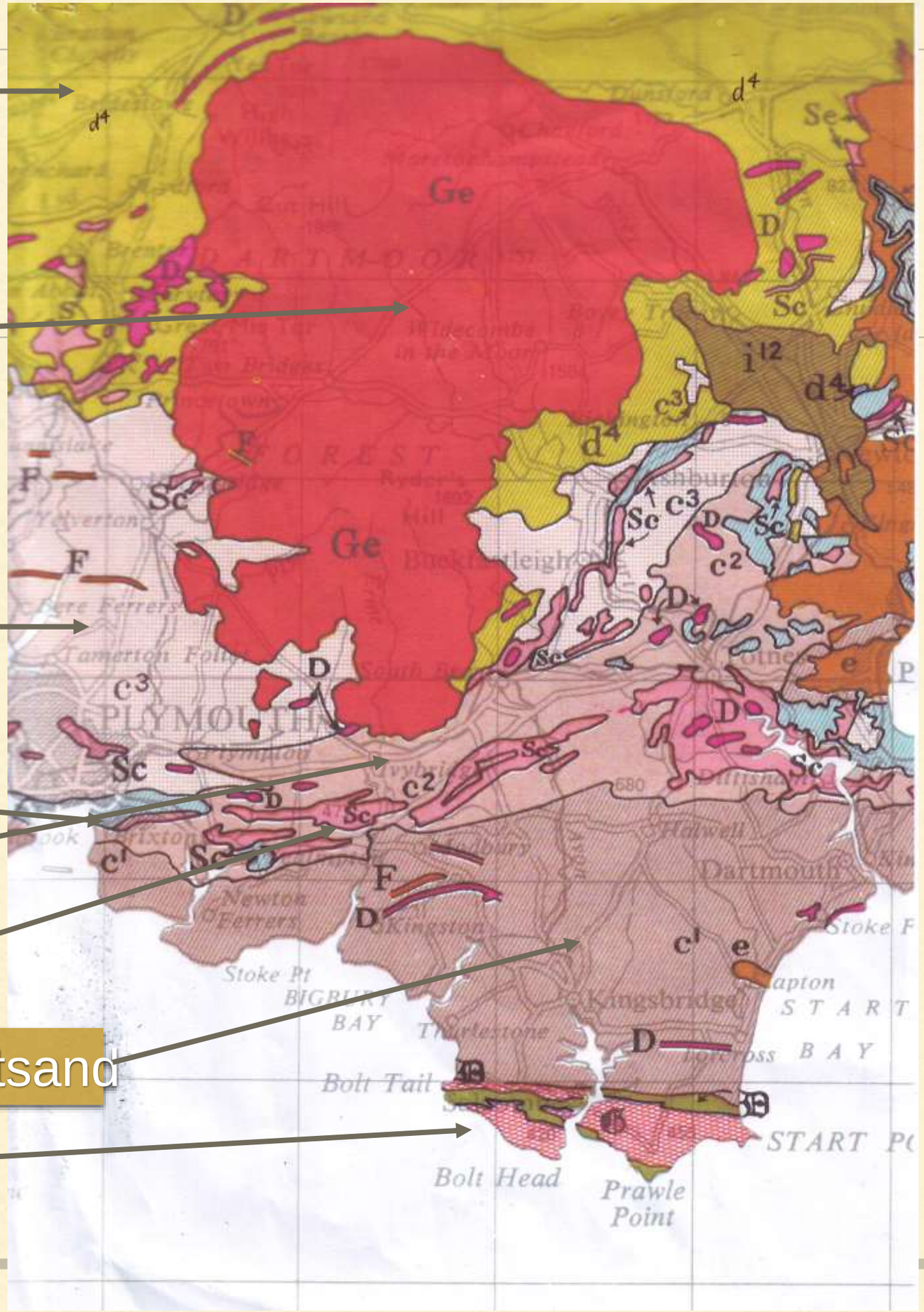
limestone

saltash

lava & tuff

Bovisand & Whitsand

schists



Dartmoor & Plymouth

SITE VISITS

CULM BASIN

TAVY BASIN

SOUTH DEVON BASIN

LOOE BASIN

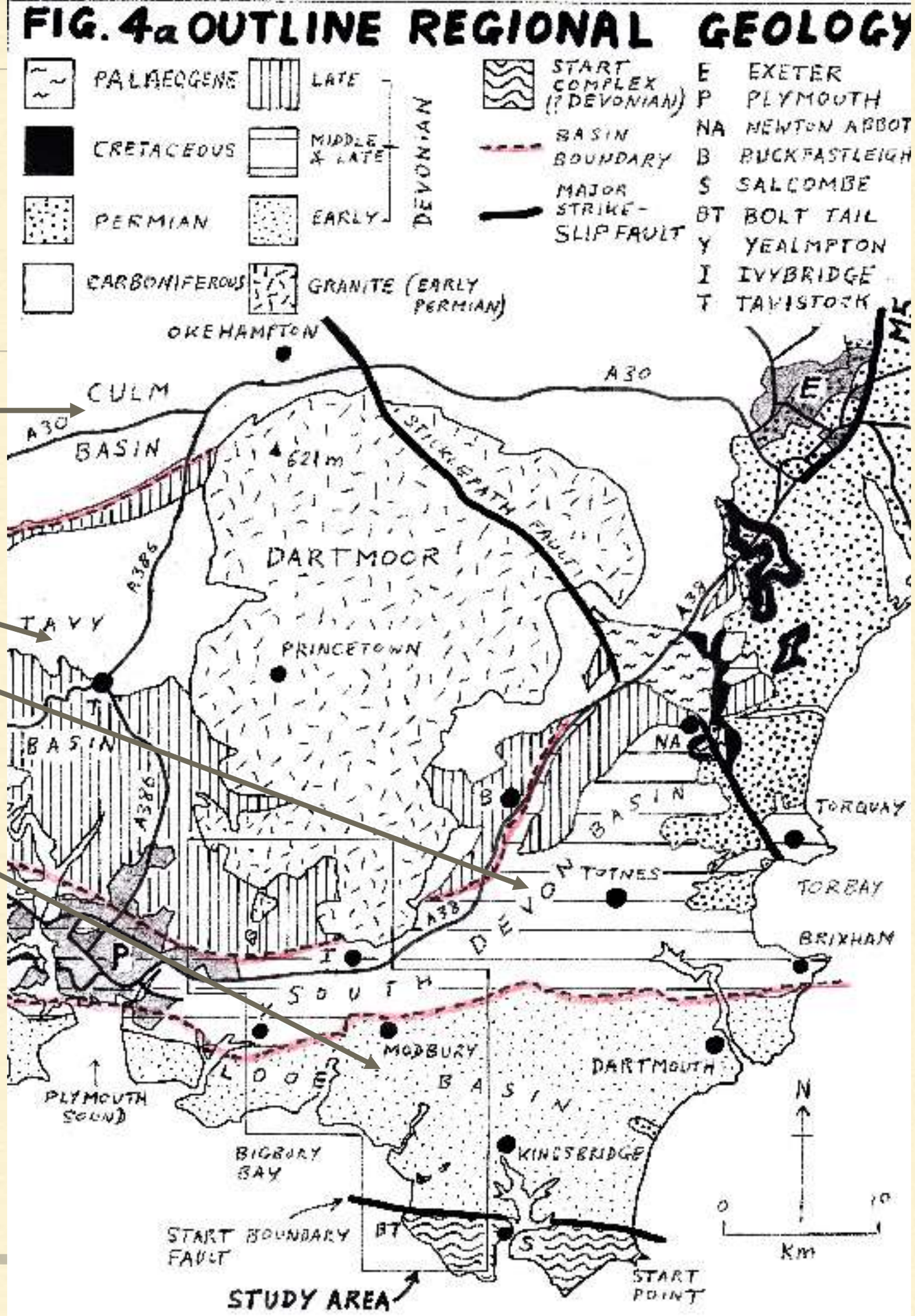
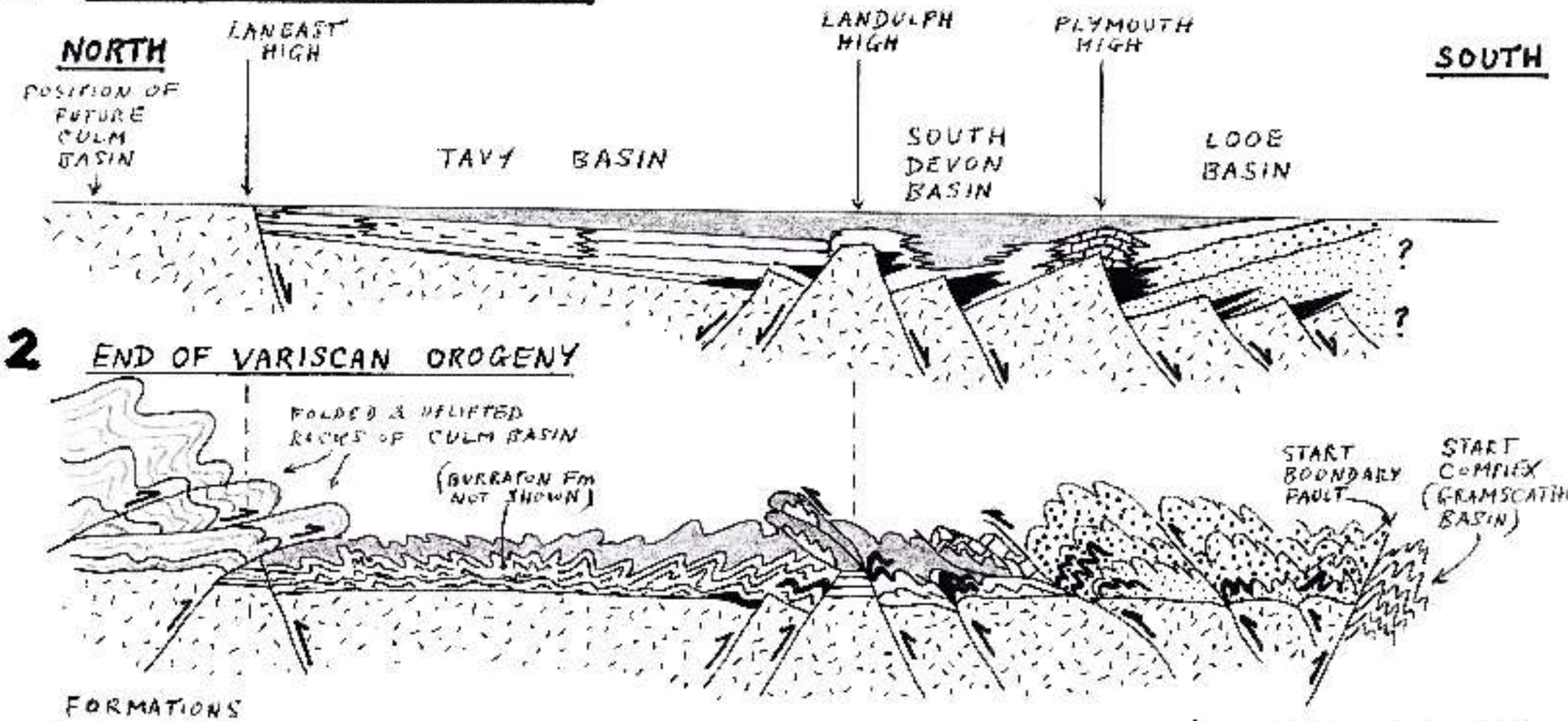


FIG. 4b BASIN EVOLUTION

1 END OF DEVONIAN PERIOD



2 END OF VARISCAN OROGENY

FORMATIONS

- SALTASH
- STADDON & BOVISAND
- WHITSAND BAY
- TAVY
- TORPOINT
- PLYMOUTH LIMESTONE
- BURRATON

- MOVEMENT ON FAULTS
- VOLCANICS & INTRUSIVES LOCALLY WITH METALLIFEROUS DEPOSITS
- RIFTED CRUST (MOSTLY PRECAMBRIAN)

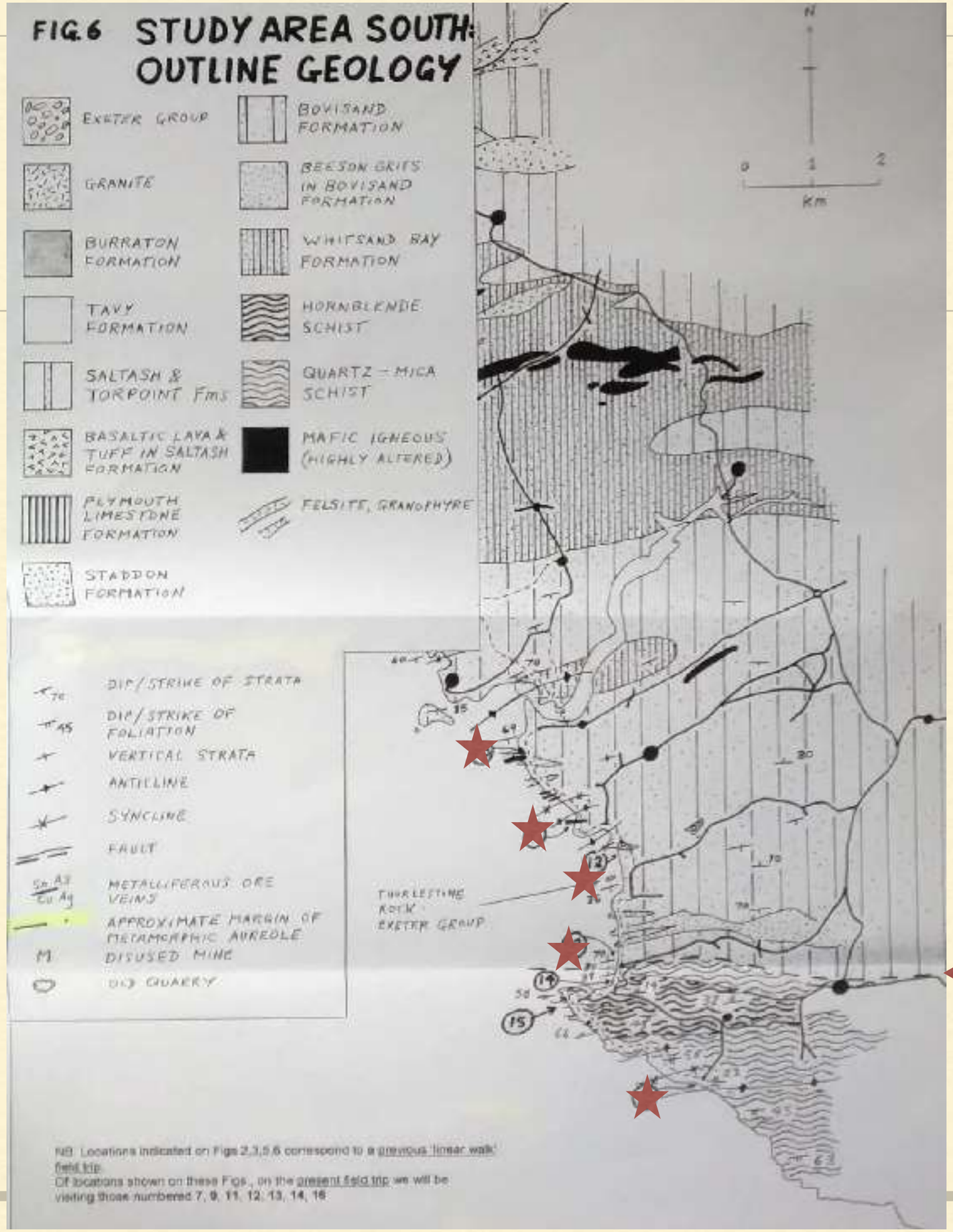
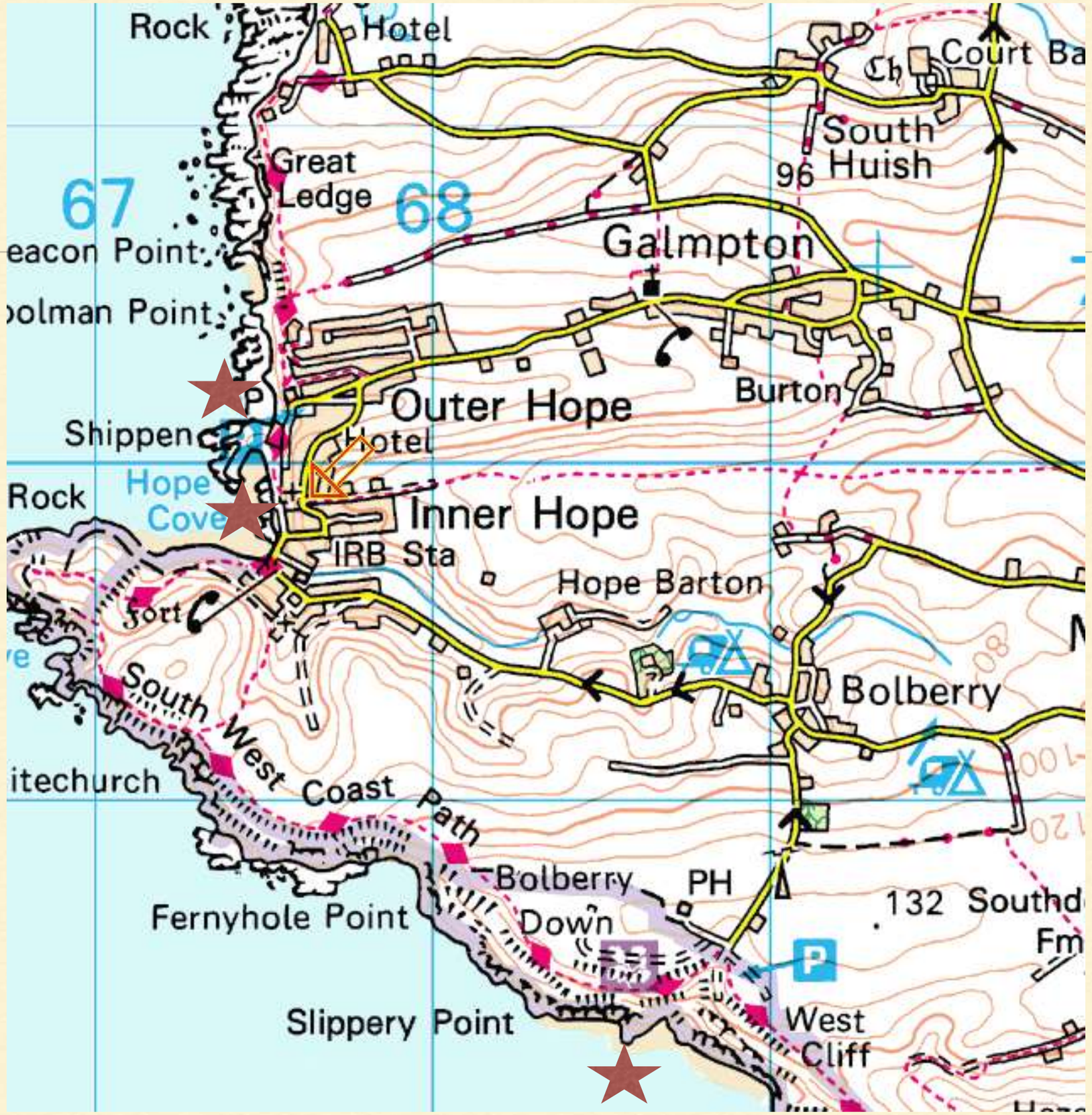


FIG.6 STUDY AREA SOUTH:
OUTLINE GEOLOGY
EXETER GROUP
GRANITE
BURRATON FORMATION
TAVY FORMATION
SALTASH & TORPOINT Fms
BASALTIC LAVA & TUFF IN SALTASH FORMATION
PLYMOUTH LIMESTONE FORMATION
STADDON FORMATION
BOVISAND FORMATION
BEESON GRITS IN BOVISAND FORMATION
WHITSAND BAY FORMATION
HORNBLENDE SCHIST
QUARTZ - MICA SCHIST
MAFIC IGNEOUS (HIGHLY ALTERED)
FELSITE, GRANOPHYRE
DIP/STRIKE OF STRATA
DIP/STRIKE OF FOLIATION
VERTICAL STRATA
ANTICLINE
SYNCLINE
FAULT
METALLIFEROUS ORE VEINS
APPROXIMATE MARGIN OF METAMORPHIC AUREOLE
DISUSED MINE
OLD QUARRY
N
0 1 2
Km
TORRIDONIAN ROCK
EXETER GROUP
NB Locations indicated on Figs 2,3,5,6 correspond to a previous 'linear walk' field trip.
Of locations shown on these Figs., on the present field trip we will be visiting those numbered 7, 9, 11, 12, 13, 14, 16
STRIKE
TERRANE BOUNDARY

STORMY HOPE BAY on the evening before the trip


Rock
Hotel
Ch
Court Ba
South
Huish
96
Great
Ledge
67
68
eacon Point
olman Point
Galmpton
Burton
Outer Hope
Shippen
Hotel
Hope
Cove
Rock
Inner Hope
IRB Sta
Hope Barton
Fort
South West Coast Path
Bolberry
itechurch
Bolberry
Down
PH
Fernyhole Point
132
Southd
Fm
Slippery Point
West
Cliff

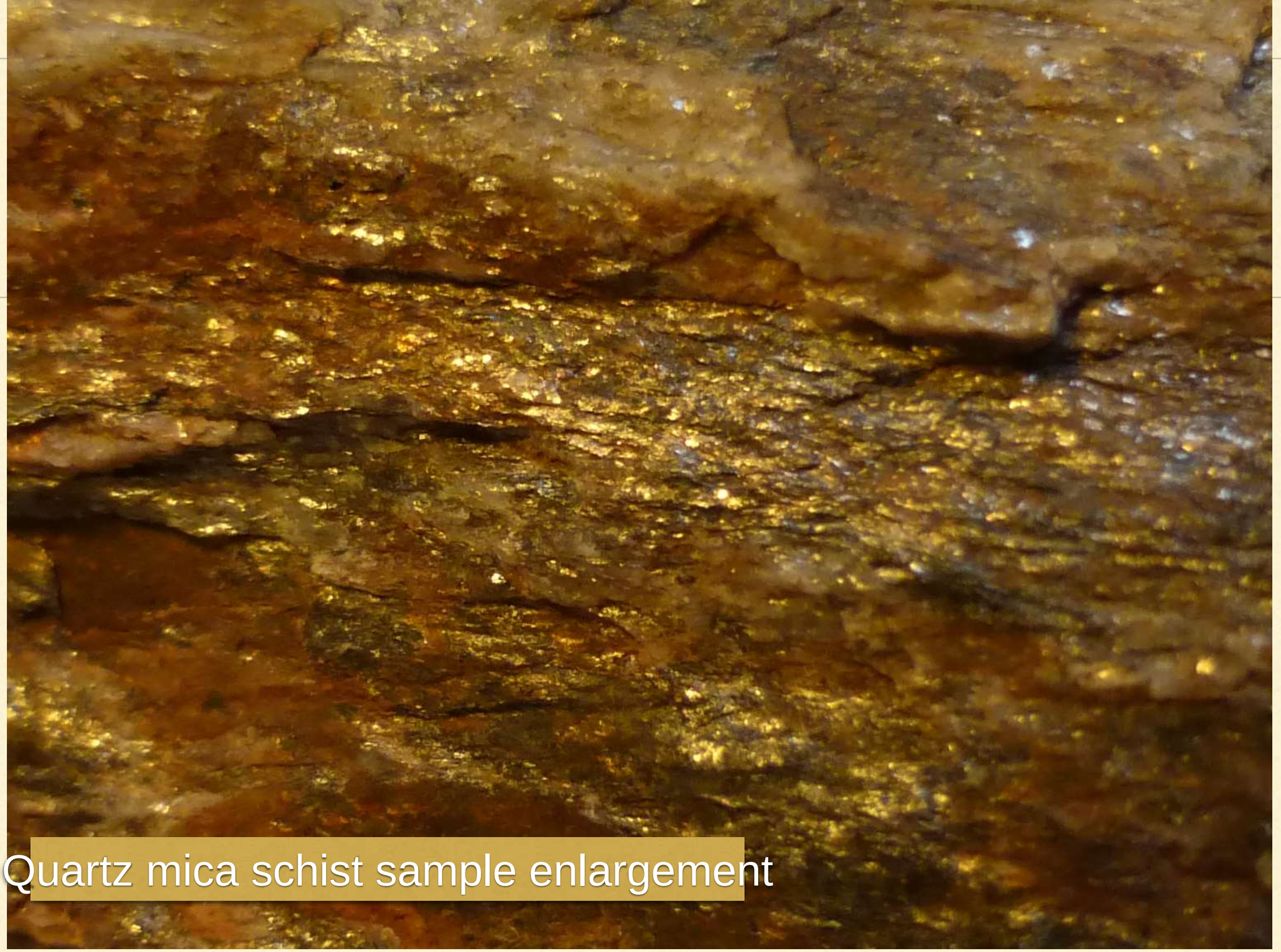
BOLBERRY DOWN

waiting to start

looking East to Bolt Head

Bolberry. Quartz-mica schist

Quartz mica schist sample



Quartz mica schist sample enlargement

Bolberry. Quartz vein in Schist overhang

Hope Bay South. weathered quartz mica schist

Hope Bay South. weathered quartz mica schist

Hope Bay South Quartz Mica schist with quartz veins

Hope Bay South. Group discussion

Hope Bay South. Cave and faulting

Hope Bay South.
Searching for contact with Horneblende schist

Hope Bay South.
Horneblende Schist ?

Horneblend schist

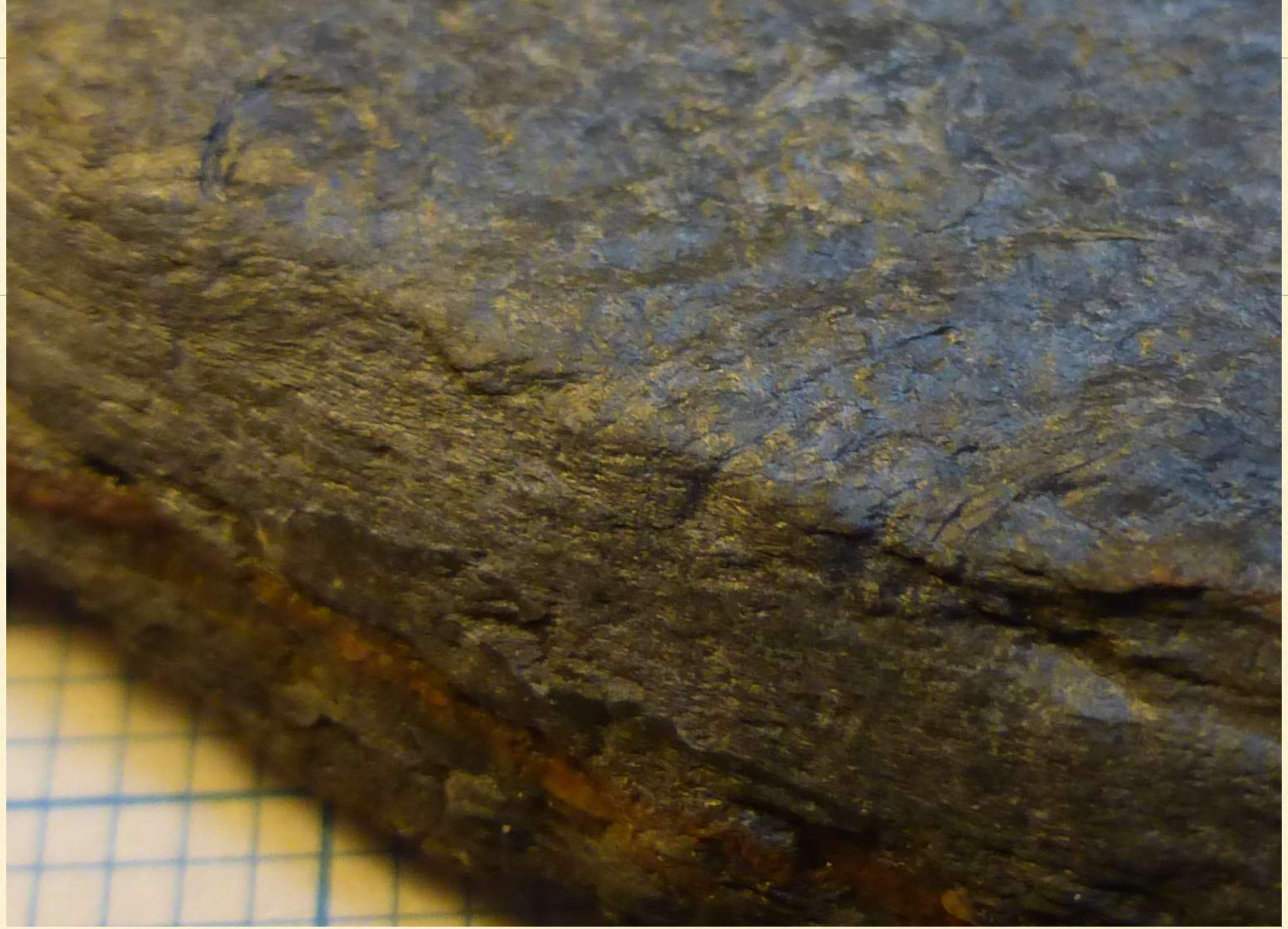
Horneblende schist sample enlarged

Lunch break Hope bay North

Hope Bay North Quartz mica schist with quartz vein

Hope Bay North Micro folds in Bovisand Formation

Bovisand sample



Bovisand sample enlarged


Cockleridge
Ferry
P
Clanacombe
PH
Bantham
Buckland
Thurlestone
Cove
22
P
Court Park
Hôtel
Loam Castle
Whitlocksworthy
PC
CH
Works
25
8
Warren Point
The Books
P
PC
Southdown
Thurlestone
Rock
5
Hotel

Permian conglomerate overlaying Devonian Bovisand with ang

close-up of unconformity

Permian conglomerate (poor colour reproduction)


102
Okenbury
Marwell
Scobbiscombe
Castle Fm
101
PH
Hoist
Point
South West
Coast Path
Ringmore
Westcombe
Beach
Ayrmer Cove
Toby's Point
Challaboroug
Warren Point
Hotel
Bigbury-on-Sea
PH
PC

Ayrmer Cove

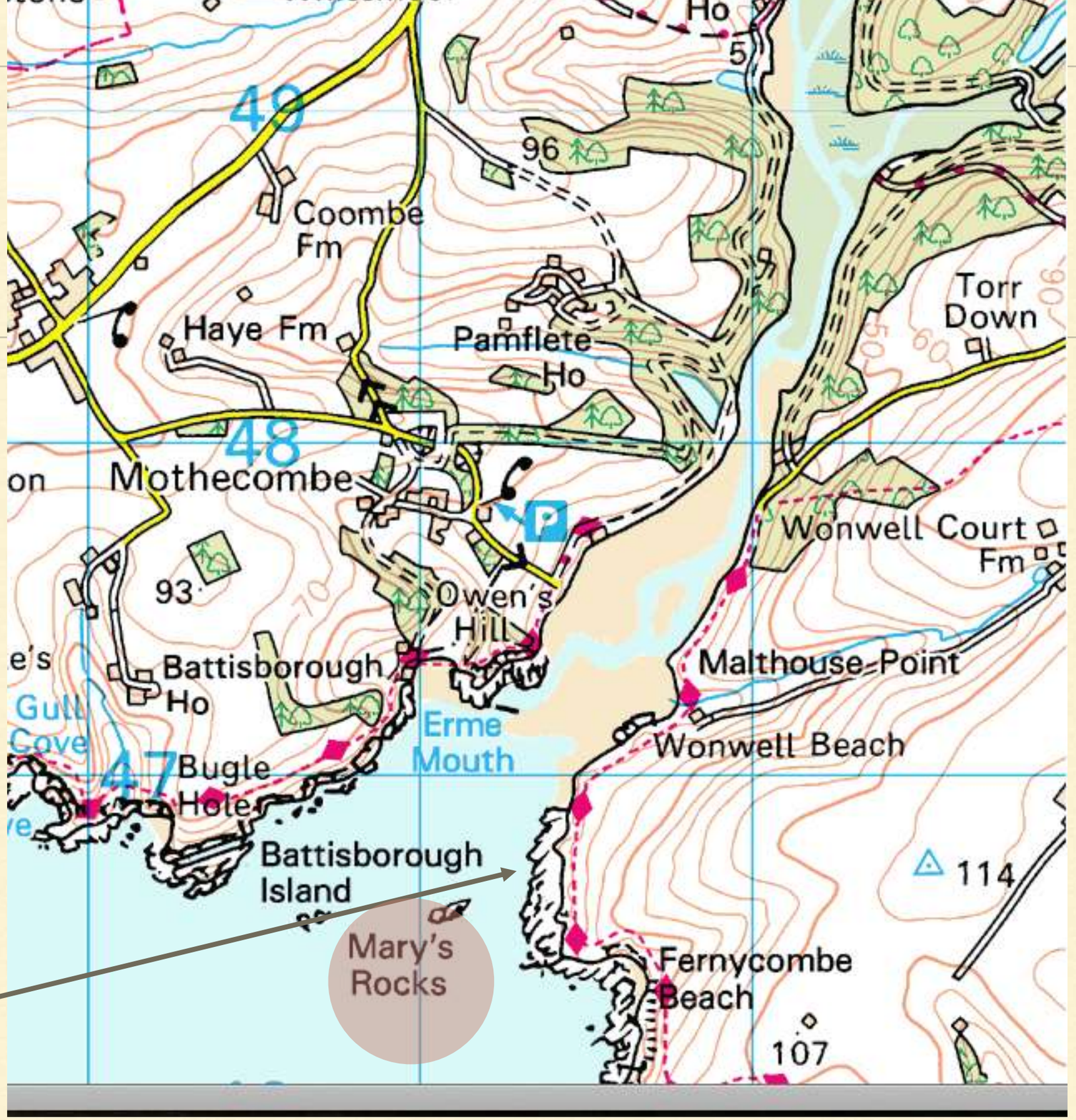
Ayrmer Cove distant view of Bovisand Formation

Ayrmer Cove showing extreme dip

sea-polished Bovisand, highly reflective grey rocks

looking down on Bovisand in Ayrmer Bay

Bovisand formation showing strike



River Erme estuary

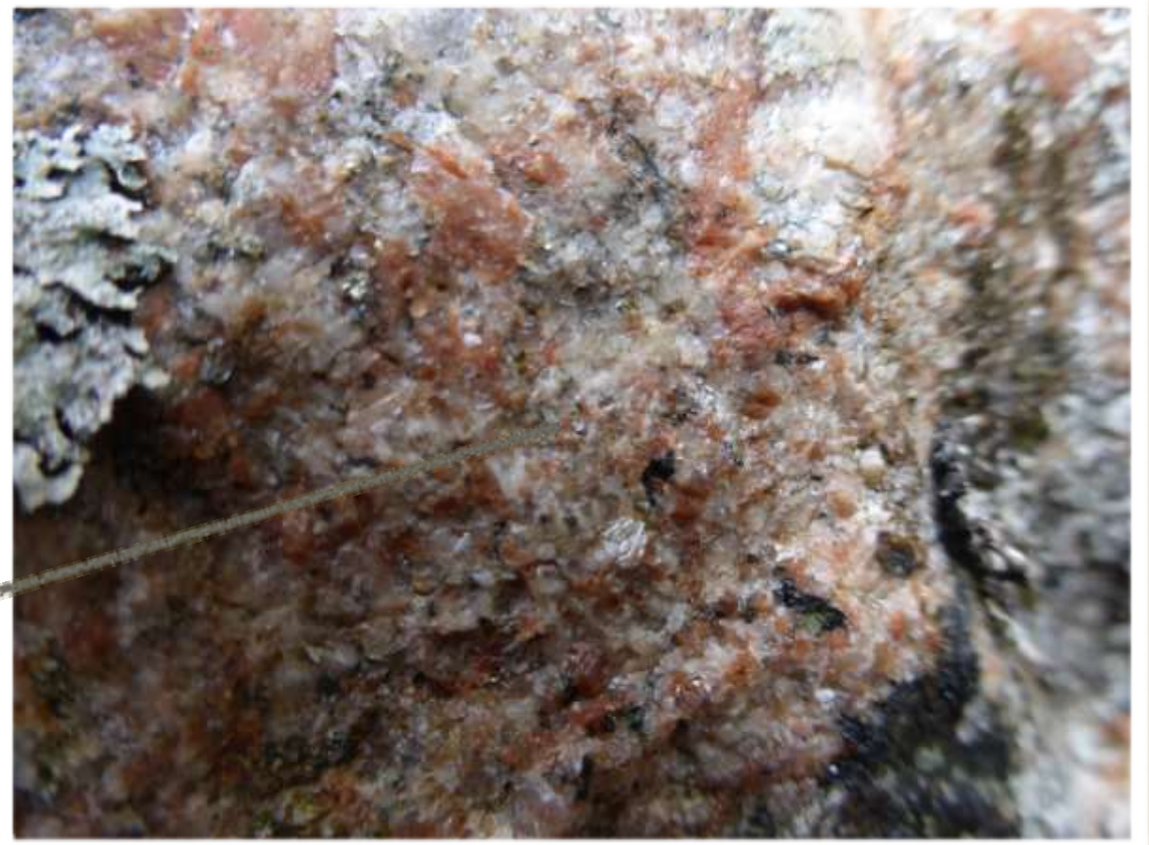
Erme estuary: Whitsand Bay formation

Erme estuary:Whitsand bay formation with chert

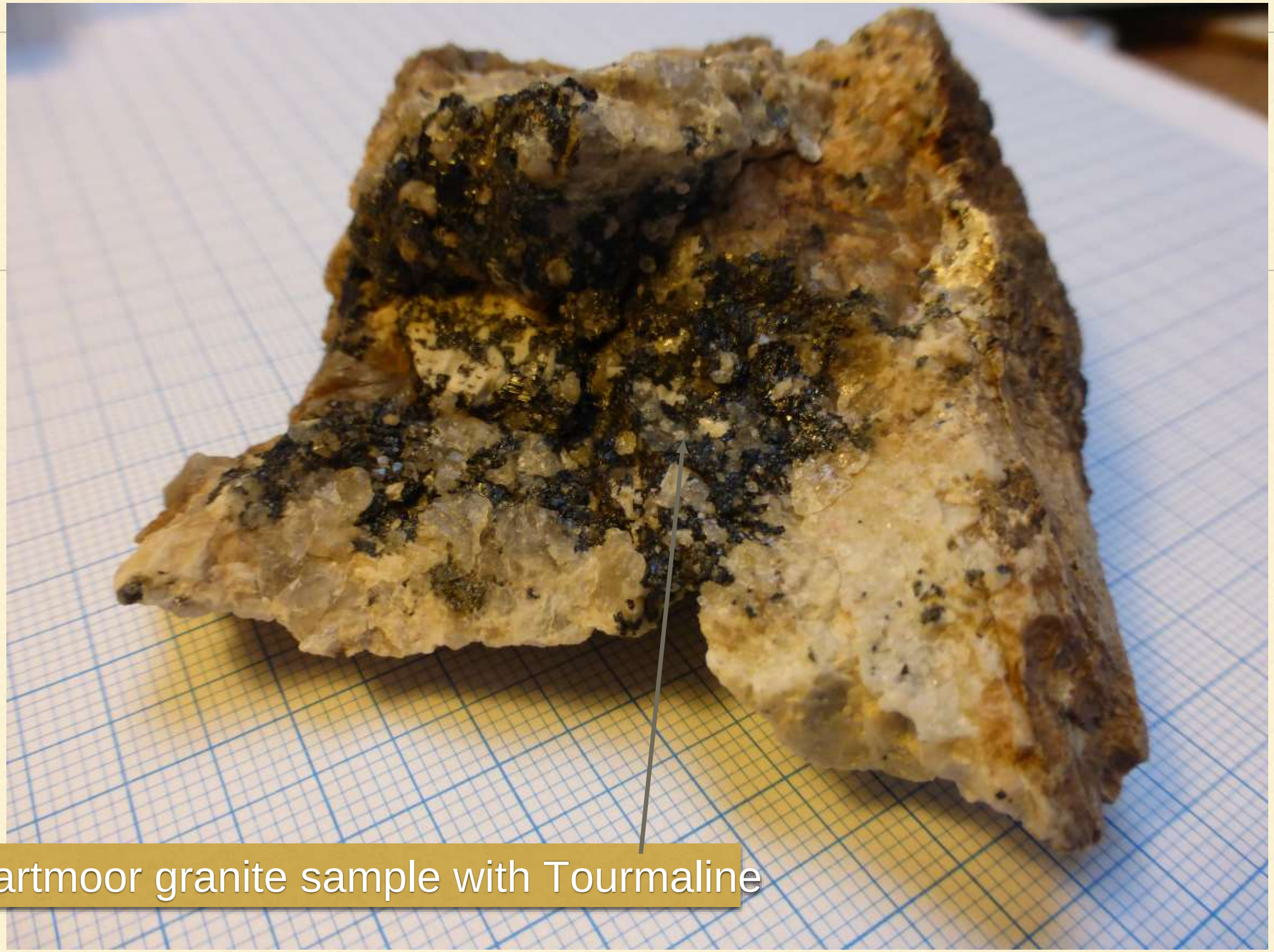
Erme estuary: mafic igneous insertion inspected by Elizabeth

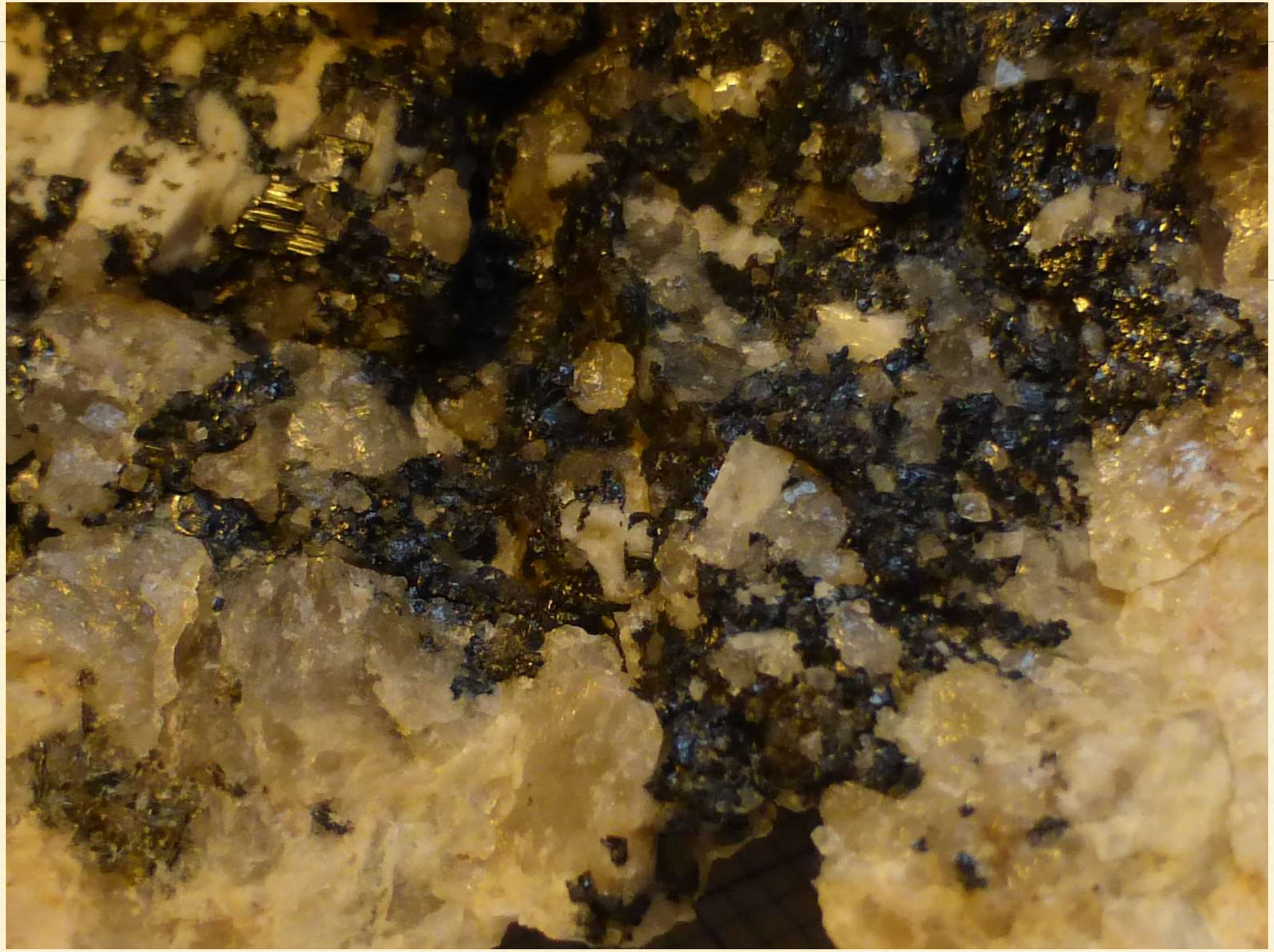
Dartmoor: Burrator reservoir


Yennadon Down
Mine (dis)
Quarry (dis)
Yelverton Reservoir
Burrator Lodge
Waterfall
Dam
Weir
Quarry (dis)
FB
Dismantled Railway
PC
Burrator
Pixeycombe
Burrator Waterfall
Burrator Wood
Meavy
Flat Wood
Higher Meavy Bridge
Yeo Farm
234
222
206
226
148
301
290
250
280
270
230
190
160



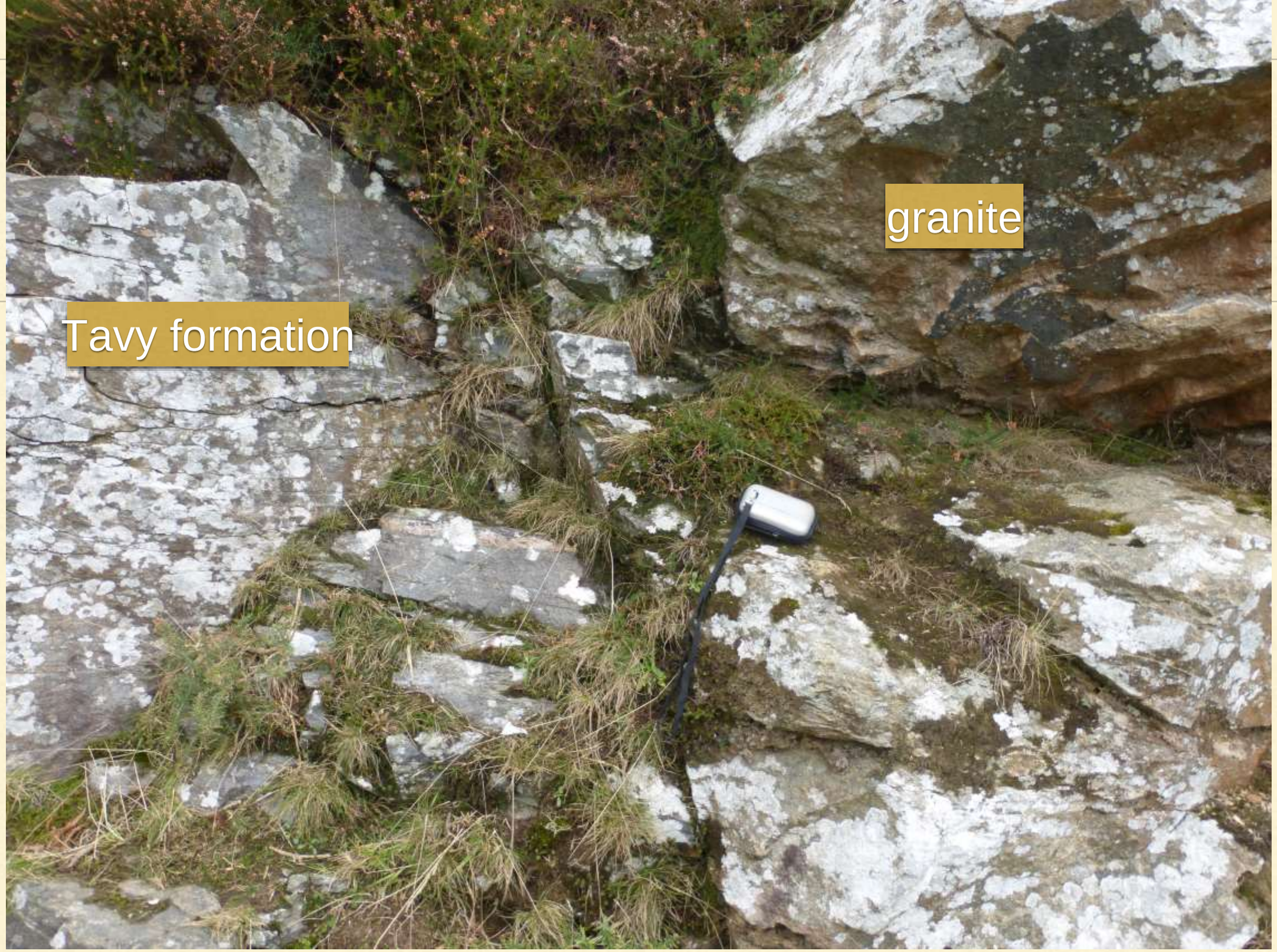
Burrator Quarry
Dartmoor granite


Dartmoor granite sample with Tourmaline



Dartmoor granite sample enlarged (Tourmaline)

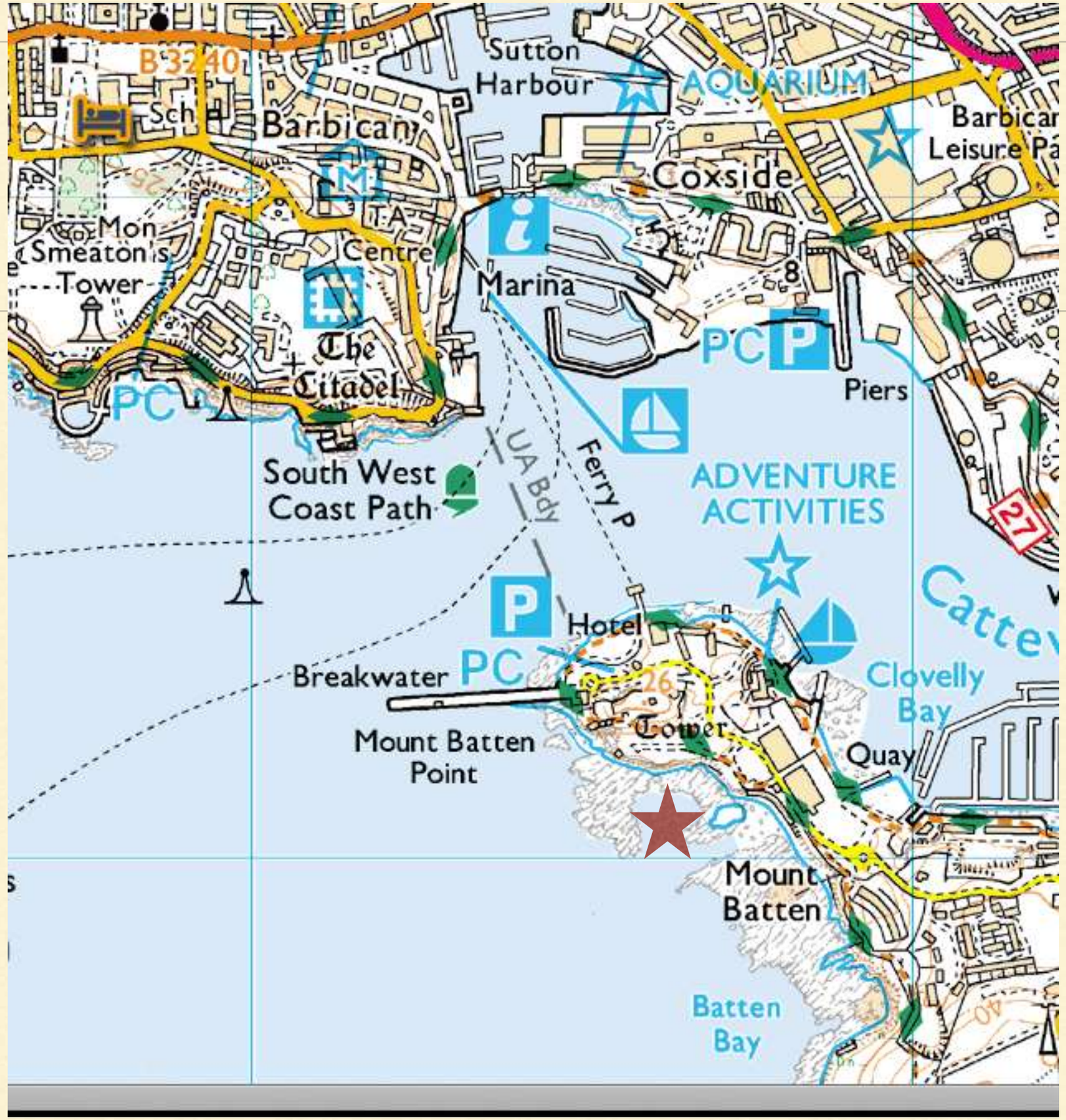
**tor quarry: Granite dyke in metamorphic hornfelsed Tavy forma
(metamorphic aureole around granite)**



Burrator quarry
Contact between granite and Tavy formation


Tavy Formation outside aureole
metamorphosed Tavy formation from close to granite

Dartmoor granite Tors


B3240
Sch
Sutton Harbour
AQUARIUM
Barbican
Barbican Leisure Pa
Coxside
Mon
Smeaton's Tower
TA Centre
Marina
The Citadel
PC
P
Piers
South West Coast Path
UA Bdy
Ferry P
ADVENTURE ACTIVITIES
27
Hotel
Breakwater
PC
26
Clovelly Bay
Tower
Quay
Mount Batten Point
Mount Batten
Batten Bay


Plymouth High Limestone

Plymouth limestone

Plymouth limestone (enlarged)


THE END